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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/776,329	02/02/2001	Sean M. Seutter	AMAT/5192/ISM/CORE MCVD/S	9575

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APPLIED MATERIALS, INC.
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SANTA CLARA, CA 95050

EXAMINER

THOMAS, TONIAE M

ART UNIT	PAPER NUMBER
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2822

DATE MAILED: 02/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/776,329

Applicant(s)

SEUTTER ET AL.

Examiner

Toniae M. Thomas

Art Unit

2822

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 11 November 2002.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-50 is/are pending in the application.
- 4a) Of the above claim(s) 29-31 and 48-50 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 4-8 and 32-34 is/are allowed.
- 6) ☒ Claim(s) 1-3, 9-25, 27, 28, 35-37, 39-43, 45 and 46 is/are rejected.
- 7) ☒ Claim(s) 26, 38, 44 and 47 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 27 April 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 1, 2, 3, 5. 6) ☐ Other:

DETAILED ACTION

1. This action is a first Office action on the merits of Application No. 09/776,329. Currently, claims 1-50 are pending.

Election/Restrictions

2. Applicant's election without traverse of Group I (claims 1-28 and 32-47) in Paper No. 6 is acknowledged. Claims 29-31 and 48-50 have been withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Information Disclosure Statement

3. The information disclosure statement filed on 04 April 2002 fails to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance, as it is presently understood by the individual designated in 37 CFR 1.56(c) most knowledgeable about the content of the information, of each patent listed that is not in the English language. Therefore, the following patents have not been considered: DE 198 20 147 A1, DE 196 27 017 A1, FR 2 626 110 A1, FR 2 692 597 A1, JP 06-291048, JP 08-264530, JP 03-048421, and JP 03-286531.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter, which the applicant regards as his invention.

Art Unit: 2822

4. *Claims 16-23 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.*

The phrase "the ammonia containing gas" lacks antecedent basis (claim 16, lines 10-11). Claims 17-23 are rejected because they depend from claim 16.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. *Claims 1-3, 9-15, 35-37, and 39-43 are rejected under 35 U.S.C. 102(e) as being anticipated by Chiang et al. (US 6,428,859 B1).*

Chiang et al. discloses a method for film deposition, which may be used to deposit barrier layers (fig. 1; col. 1, lines 17-24; and col. 6, line 39 – col. 10, line 4). The method comprises: providing a process system having a chamber 180 (fig. 1); locating a substrate 181 in the process chamber (fig. 1); providing a first reactive gas 100 to the chamber (col. 8, lines 25-32); chemisorbing a first layer on the substrate in response to the first reactive gas, wherein the first layer may be a tantalum layer (col. 7, line 59 – col. 8, line 2 and col. 8, lines 25-32); conditioning the chamber with an evacuation (col.

Art Unit: 2822

8, lines 32-34); providing a second reactive gas to the chamber (col. 8, lines 35-53); chemisorbing a second layer on the first layer in response to the second reactive gas (col. 8, lines 35-53). The second reactive gas comprises generated radicals 176 (col. 8, lines 36-40). Because ammonia may be used to generate the radicals 176 (col. 7, lines 4-12), the second layer would be a nitride layer if ammonia were used as the second reactive gas.

The first and second layers may be formed sequentially or simultaneously (col. 9, lines 35-46).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. *Claims 24, 25, 27-28, 45-46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nogami et al. (US 6,001,415 B1) in view of Chiang et al.*

Nogami et al. discloses of forming a barrier layer structure and an interconnect structure for use in an integrated circuit (figs. 1-7 and accompanying text). The method comprises: providing a substrate having an oxide layer 24 thereon, wherein the dielectric layer has a recess formed to expose a portion of a surface of the substrate (fig. 3); forming a barrier layer 42 on the dielectric layer and the substrate, wherein the barrier layer may comprise tantalum nitride (fig. 4 and col. 3, lines 54-62); etching

Art Unit: 2822

through portions of the tantalum nitride layer (fig. 5); depositing a metal layer 62 of copper in the recess (fig. 6 and col. 4, lines 22-31), wherein the barrier layer prevents the migration of copper from the metal to the dielectric layer (col. 4, lines 46-52).

In the instance when tantalum nitride is used as the barrier layer 42, Nogami et al. do not teach depositing the tantalum nitride layer using a sequential chemisorption of tantalum containing and nitrogen containing precursor gases.

As discussed above, Chiang et al. teach a method of depositing a film using a sequential chemisorption method, wherein tantalum containing and nitrogen containing precursor gases may be used to deposit the film (fig. 1; col. 1, lines 17-24; and col. 6, line 39 – col. 10, line 4).

In the instance when the barrier layer 42 is a tantalum nitride layer, one having ordinary skill in the art would have been motivated to modify Nogami et al. by forming the tantalum nitride layer 42 using a sequential chemisorption of tantalum containing and nitrogen containing precursor gases, as taught by Chiang et al., because this method provides conformal, ultra-thin tantalum nitride layers at temperatures relatively lower than temperatures used in CVD processes (Chiang et al. – col. 3, lines 22-26).

Allowable Subject Matter

7. *Claims 4-8 and 32-34 are allowable.* The prior art of record does not anticipate, teach or suggest the step of plasma annealing the tantalum-nitride layer to remove nitrogen therefrom.

Art Unit: 2822

8. *Claim 16 would be allowable if rewritten or amended to overcome the rejection under 35 U.S.C. 112, second paragraph, set forth in this Office action. Claims 17-23 would be allowable if rewritten to overcome the rejection under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.* The prior art of record does not anticipate, teach or suggest the step of forming plasma for annealing the chemisorbed second layer.

9. *Claims 26, 38, 44, and 47 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.* Claims 26 and 47 would be allowable because the metal layer deposited in the recess is not a refractory metal. Claim 38 would be allowable for the same reason claims 4-8 and 32-34 are allowable. Claim 44 would be allowable because the prior art of record does not anticipate, teach or suggest maintaining the substrate approximately above a thermal decomposition temperature of the tantalum containing gas.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (703) 305-7646. The examiner can normally be reached from 8:30AM to 5:00PM, Monday through Thursday, and alternating Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (703) 308-4905. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 305-3432 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

Application/Control Number: 09/776,329

Page 7

Art Unit: 2822

JMJ

January 27, 2003


AMIR ZARABIAN
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800